Research Department
Federal Reserve
Bank of
San Francisco

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Weekly Letter

Interest Rates and Exchange Rates: I The Relationship

Conventional wisdom says that a rise in U.S. interest rates relative to abroad strengthens the dollar on the foreign exchanges by attracting international capital to our shores. This argument appears so commonsensical that market commentators cite interest rates more frequently than any other factor when explaining day-to-day changes in exchange rates.

And yet, whenever U.S. interest rates have increased in recent years, the dollar has *depreciated* as often as it has appreciated. True, the dollar has moved closely with U.S. interest rates this year, but it fell fairly steadily during 1977 and 1978, when U.S. interest rates rose above foreign rates. This pattern is evident for the dollar and the German mark (Chart 1), and also for the dollar relative to other major currencies.

This ambiguous relation seems all the more puzzling because the difference between U.S. and foreign interest rates has moved virtually in "lock-step" with the forward discount on the dollar—that is, the current value of the dollar minus its forward (futures) value (Chart 2). This means that if interest-rate differences across countries do not cause a change in the *current* value of the dollar, they must lead to a change in its *futures* value. Thus we should examine the circumstances under which a change in relative interest rates will cause the current value of the dollar to vary, versus those circumstances under which its forward value will be affected.

Paradox?

Two basic factors can cause interest rates to rise—but they have very different impacts upon exchange rates. In effect, every interest rate is composed of a *real yield* plus an *inflation premium*. The real part of the interest rate is simply the compensation in terms of goods and services paid to the lender for the use of his money; this is equal to the difference between the purchasing power of the amount repaid and the purchasing power of the original loan. In addition, part of each interest payment is designed to compensate the lender for the erosion in the purchasing power of the asset due to inflation. This part of the interest payment is the "inflation premium". For example, suppose that the interest rate on a one-year loan is 12 percent while inflation is expected to average 10 percent over the year. The purchasing power of the principal thus declines by 10 percent during the year, so that 10 of the 12 percentage points of the interest charge represents an inflation premium—leaving a real interest payment of 2 percentage points.

As its name implies, the inflation-premium part of market interest rates reflects the inflation anticipated over the life of the loan. Hence, so long as the real yield remains fixed, market interest rates will rise or fall as expected inflation waxes or wanes. For that reason, interest rates generally tend to be highest in those nations with relatively high inflation rates.

The real interest-rate portion of market yields, on the other hand, reflects in the long run the productivity of a nation's economy. Short-run fluctuations in the real yield usually result from cyclical fluctuations or changes in liquidity. For example, in view of the substantial lag between money changes and price changes, sudden reductions in money growth tend to reduce liquidity and hence (all other factors equal) to raise the real interest rate. Likewise, business-cycle variations in real income can affect real interest rates by changing the real demand for money.

Arbitrage . . .

In contrast to its ambiguous relation with exchange rates, the interest differential between

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the U.S. and abroad usually varies closely and consistently with the forward discount on the dollar. The forward discount vis-a-vis (say) the German deutschemark (DM) is simply the percentage difference between the amount of marks one dollar will buy now and the forward (futures) price of marks (Chart 2). The forward price is the amount of DM an individual can contract to buy now with a dollar at some future date.

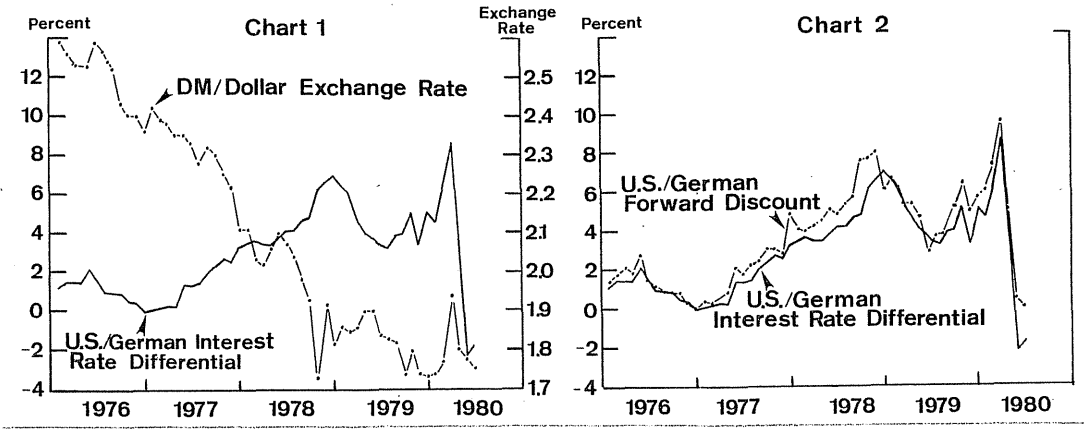
In the absence of capital controls, profit-seeking investors will seek to obtain roughly the same dollar yield from comparable U.S. and foreign securities ("comparable" in terms of maturity, liquidity, and default risk). A U.S. citizen, for example, can purchase marks in the spot exchange market and use the proceeds to purchase a German security. Moreover, he can hedge the return against a fall in the mark (relative to the dollar) by selling now the DM (that he will receive at maturity) in the forward-exchange market. Thus he knows immediately what his return in dollars will be, and he knows that this return will not be affected by any future changes in the value of the DM against the dollar.

With this exchange risk "covered", arbitragers are encouraged to move funds between countries until the interest-rate differences equal the forward discount on the dollar. Actual or prospective capital controls of course can impede such international transfers of funds and so "break" this linkage. However, such controls have not been significant in major industrial countries in recent years.

The forward value of the dollar tends to reflect market expectations about what the (spot) price of the dollar will be in the future. Suppose, for example, that the one-year forward price of marks was 2DM/dollar, but that the price expected one year hence was only 1.80DM/dollar. Then an individual who purchased 2DM now for one dollar could expect to sell them later for about $1.10. The potential profit from such "speculation", although involving some risk, tends to make the forward and anticipated future values of the dollar move together.

. . . and exchange rates

Taken together, these facts largely explain the "paradoxical" variations in exchange rates vis-a-vis interest rates. Basically, increases in real interest rates tend to raise the current value of the dollar, while interest-rate increases due to inflationary expectations tend to lower the forward rate. Consider, for example, a situation where U.S. money growth decelerates, but presumably only on a temporary basis. The likely consequence is a temporary shortage of liquidity, along with a rise in real U.S. interest rates. Foreigners thus find it attractive to purchase U.S. securities. The resulting increase in the demand for dollars then pushes up the spot exchange value of the dollar. But without a change in inflation expectations (and thus in the expected level



of U.S. prices), the future value of the dollar will not change. In this case the interest-rate differential will equal the forward discount, because the higher U.S. interest rate will lead to a higher spot rate for the dollar.

On the other hand, a rise in U.S. interest rates due to an increase in anticipated inflation will not attract foreign investment into U.S securities. That is, the higher U.S. rates will just compensate investors for the expected increase in inflation, and so the current value of the dollar will not necessarily rise. However, because of the anticipated rise in the level of U.S. prices, the future value of the dollar will be expected to fall, driving down the forward exchange value of the dollar. In this case the interest-rate differential will equal the forward discount on the dollar, because the higher U.S. interest rate will be associated with a fall in the forward value of the dollar. Furthermore, the spot value of the dollar will subsequently fall as U.S. prices rise above those abroad. Indeed, because exchange rates often move ahead of current trends, the dollar's spot value may even fall somewhat immediately.

It should now be clear why the dollar has moved closely with U.S. interest rates this year, after moving in the opposite direction in 1977 and 1978. The increase in U.S. interest rates early in 1980 largely reflected a rise in real yields, due to the liquidity squeeze caused by reduced U.S. money growth and the Federal Reserve's credit-restraint program. Hence the dollar rose during this period. But then the dollar declined in the spring, in the wake of recession-caused declines in market and real interest rates. On the other hand, during the 1977-78 period, increasing money growth in the U.S. led to accelerating inflation here relative to abroad. In this case, U.S. interest rates rose because of increases in the inflation premium, and the dollar fell as a result.

In fact, since the beginning of the floating exchange-rate regime in 1973, prolonged interest-rate increases have more often than not been associated with a depreciation of the currency. Interest-rate changes thus largely reflect variations in expected inflation. This is not surprising, in view of the substantial variations in money-growth rates here and abroad since 1973. But this observation also illustrates the crucial importance of monetary policies in determining the relations observed between interest rates and exchange rates. In particular, to the extent that the recent Federal Reserve change in money-control procedures leads to steadier money growth and less inflation variability, U.S. interest rates and the foreign-exchange value of the dollar may move together more often in the future than they have in the past. This point is discussed further in our next article.

Michael Keran & Charles Pigott

BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 8/27/80	Change from 8/20/80	Change from year ago Dollar	Change from year ago Percent
Loans (gross, adjusted) and investments*	138,499	384	6,520	4.9
Loans (gross, adjusted) — total#	116,778	341	7,864	7.2
Commercial and industrial	33,812	194	2,039	6.4
Real estate	47,427	213	7,376	18.4
Loans to individuals	23,532	45	422	1.8
Securities loans	872	− 16	− 1,143	− 56.7
U.S. Treasury securities*	6,337	47	− 1,174	− 15.6
Other securities*	15,384	− 4	− 170	− 1.1
Demand deposits — total#	42,288	−1,299	194	0.5
Demand deposits — adjusted	31,106	− 431	− 20	− 0.1
Savings deposits — total	29,393	− 8	− 1,118	− 3.7
Time deposits — total#	62,830	241	10,056	19.1
Individuals, part. & corp.	54,647	247	10,310	23.3
(Large negotiable CD's)	23,567	198	4,404	23.0

Weekly Averages of Daily Figures	Week ended 8/27/80	Week ended 8/20/80	Comparable year-ago period
Member Bank Reserve Position			
Excess Reserves (+)/Deficiency (−)	− 86	41	33
Borrowings	24	36	146
Net free reserves (+)/Net borrowed(−)	− 110	5	− 114

* Excludes trading account securities.
\# Includes items not shown separately.

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